

What Is Claimed Is:

1. A method for identifying a molecule that modulates the biological activity of a native quadruplex DNA, which comprises

contacting a test quadruplex DNA with a candidate molecule, wherein the test quadruplex DNA comprises the nucleotide sequence (GGA)₄ or the nucleotide sequence (GGA)₃GG, and wherein G is guanine and A is adenine; and

determining the presence or absence of an interaction between the candidate molecule and the test quadruplex DNA, whereby the candidate molecule that interacts with the test quadruplex DNA is identified as the molecule that modulates the biological activity of the native quadruplex DNA.

2. The method of claim 1, wherein the test quadruplex DNA comprises a nucleotide sequence selected from the group consisting of

(GGA)₄AGA(GGA)₃GGC;
(GGA)₄;
AGAGAAGAGG(GGA)₃GAGGAGGAGGCGC;
GGAGGGGGAGGGG;
AGGAGAA(GGA)₂GGT(GGA)₃G₃;
(GGA)₃AGAATGCCA(GGA)₂G₃AGGAG;
CCGAA(GGA)₂A(GGA)₃G₄;
(GGA)₂CCGA(GGA)₂;
GGAA(GGA)₃;
AGAAGAG(GGA)₃G; and
AGCGA(GGA)₈GAGGAA

3. The method of claim 1, wherein the test quadruplex DNA comprises a nucleotide sequence that is identical to a nucleotide sequence in native quadruplex DNA.

4. The method of claim 1, wherein the test quadruplex DNA comprises a nucleotide sequence that is identical to a gene transcription regulatory nucleotide sequence in native quadruplex DNA.

5. The method of claim 1, wherein the test quadruplex DNA is in a heptad/tetrad conformation.

6. The method of claim 5, wherein the heptad/tetrad conformation of the test quadruplex DNA is formed by incubating the DNA in a solution comprising potassium ions for a time period less than the time period required to form another quadruplex conformation.

7. The method of claim 5, wherein the test quadruplex DNA comprises a mutation that hinders formation of another quadruplex conformation.

8. The method of claim 1, wherein the test quadruplex DNA is coupled to a reporter expression system.

9. The method of claim 8, wherein the reporter expression system comprises a luciferase reporter.

10. The method of claim 1, wherein the interaction is assayed by a Taq polymerase arrest assay.

11. The method of claim 1, wherein the interaction is a binding interaction.

12. A method for modulating the biological activity of a biologically significant native quadruplex DNA, which comprises contacting a system comprising the native quadruplex DNA with a molecule that interacts with quadruplex DNA comprising the nucleotide sequence (GGA)₄ or the nucleotide sequence (GGA)₃GG, wherein G is guanine and A is adenine; whereby the molecule modulates the biological activity of the native quadruplex DNA.

13. The method of claim 12, wherein the native quadruplex DNA comprises a nucleotide sequence selected from the group consisting of
(GGA)₄AGA(GGA)₃GGC;

(GGA)₄;
AGAGAAGAGG(GGA)₅GAGGAGGAGGCGC;
GGAGGGGAGGGG;
AGGAGAA(GGA)₂GGT(GGA)₃G₃;
(GGA)₃AGAATGCGA(GGA)₂G₃AGGAG;
CCGAA(GGA)₂A(GGA)₃G₄;
(GGA)₂CCGA(GGA)₂;
GGAA(GGA)₃;
AGAAGAG(GGA)₃G; and
AGCGA(GGA)₈GAGGAA.

14. The method of claim 12, wherein the test quadruplex DNA is in a heptad/tetrad conformation.

15. The method of claim 14, wherein the heptad/tetrad conformation of the test quadruplex DNA is formed by incubating the DNA in a solution comprising potassium ions for a time period less than the time period required to form another quadruplex conformation.

16. The method of claim 14, wherein the test quadruplex DNA comprises a mutation that hinders formation of another quadruplex conformation.

17. The method of claim 12, wherein the system is a cell.

18. The method of claim 12, wherein the system is an organism.

19. A method for identifying a quadruplex structure in a nucleic acid of a sample, which comprises contacting the sample with a quadruplex-interacting agent and detecting the presence or absence of an interaction between the nucleic acid and the quadruplex-interacting agent, whereby the presence of an interaction is indicative of the quadruplex structure in the nucleic acid.

20. The method of claim 19, wherein the quadruplex-interacting agent is TMPyP4 or telomestatin.
21. The method of claim 19, wherein the quadruplex structure is in a heptad/tetrad conformation.
22. A method for identifying a nucleotide sequence capable of forming a quadruplex structure, which comprises identifying in a database a subset of nucleotide sequences comprising $(GGA)_4$, $(GGA)_3GG$ or $(GGA)_3GGX_n(GGA)_3GG$, wherein n is an integer between 0 and 3.
23. The method of claim 22, which further comprises identifying nucleotide sequences from the subset of nucleotide sequences adjacent to a gene coding region.
24. The method of claim 22, which further comprises identifying nucleotide sequences from the subset of nucleotide sequences identical to or substantially identical to an oncogene nucleotide sequence.
25. A method for identifying a nucleotide sequence capable of forming a quadruplex structure, which comprises contacting a cell with a quadruplex interacting agent, identifying a subset of RNA nucleotide sequences increased or decreased 2-fold or more in the cell as compared to a cell not contacted with the quadruplex interacting agent, and identifying a nucleotide sequence from the subset comprising $(GGA)_4$, $(GGA)_3GG$ or $(GGA)_3GGX_n(GGA)_3GG$ as the nucleotide sequence capable of forming a quadruplex structure.
26. The method of claim 25, wherein the quadruplex interacting agent is TMPyP4 or telomestatin.